EFFECT OF DRY MACHINING ON TOOL WEAR

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ABSTRACT

This thesis presents the wear of coated carbide insert in machining carbon steel AISI 1065. Machineability of AISI 1065 is considered good with high strength, high resistance to breakage and high modulus of elasticity. This has increased the tool wear of the coated carbide when it is used to machining of AISI 1065. The main objective of this project is to examine the progress of tool wear, identify the interaction between the different parameters and to find out the optimal parameter that can be used in dry machining. In this project, 3^3 full factorial design of experiments (DOE) was employed in STATISTICA software to plan and perform the experiment systematically so that any possible experimental error would be minimized. Machining variables considered are cutting length, cutting speed and feed rate. The variables for there levels were 90, 120 and 150 rev/min for cutting speed, 0.13, 0.18, 0.22 mm/rev for the feed rate and 0.8, 1.0, and 1.2 mm for depth of cut respectively. Machining AISI 1065 was carried out by using the conventional lathe machine. The work piece is been turning for 7 rounds for each turning process. After 7 rounds of turning process, wear of the coated carbide insert was investigated and measured by using Microscope MarVision MM320 and Quadra check 300. Experimental data was analyzed in STATISTICA. Analysis of variance (ANOVA) is done to identify the most influencing parameters in this research. From the ANOVA analysis, the cutting speed and the feed rate are the most significant parameter that influencing tool wear. Depth of cut effect can be negligible. The minimum tool wears is at the lowest cutting speed that is 90rev/min and at lowest feed rate 0.13mm/rev.

ABSTRAK

Tesis ini menyajikan kehausan mata alat pemotong diselaputi karbide dalam memesinkan besi karbon AISI 1065. Kebolehmesinan besi AISI 1065 dimesinkan adalah dengan kekuatan yang tinggi, keupayaan menahan dari patah, dan nilai modulus kekenyalan yang tinggi . Ini menyebabkan alat pemotong diselaputi karbide akan cepat haus. Objektif utama projek ini ialah untuk mengkaji kemajuan kehausan alat mata, mengenalpasti interaksi antara parameter yang berlainan dan untuk mengetahui parameter yang optimum yang boleh digunakan dalam pemesinan kering. Dalam projek ini, rekaan eksperimen pemfaktoran penuh 3^3 dijanakan dalam perisian STATISTICA untuk mengatur dan menjalankan eksperimen ini secara sistematik untuk mengurangkan apa-apa ralat eksperimen yang mungkin berlaku. Parameter yang dipertimbangkan ialah kelajuan pemotongan, kadar kelajuan pemotongan dan kedalaman pemotongan. Tiga tahap parameter yang digunakan ialah 90, 120 dan 150 rev/min untuk kelajuan pemotongan, 0.13, 0.18 dan 0.22 mm/rev untuk kadar kelajuan bahan dipotong dan 0.8, 1.0 dan 1.2 untuk kedalaman pemotongan. Proses memesinkan besi AISI 1065 dijalankan dengan menggunakan mesin larik konvensional. Bahan kajian dilarikkan untuk 7 pusingan untuk setiap proses larikan. Selepas 7 proses larikan, kehausan alat pemotong disepaluti karbide dikaji dan diukur menggunakan mikroskop MarVision MM320 dan Quadra Chek 300. Data eksperimen dianalisis menggunakan STATISTICA. Analisis varians (ANOVA) dilakukan untuk mengenalpasti parameter yang paling mempengaruhi kehausan alat pemotong. Daripada analisis ANOVA, kelajuan pemotongan dan kadar kelajuan pemotongan adalah parameter yang paling penting yang mempengaruhi kehausan alat pemotong. Kesan kedalaman pemotongan boleh diabaikan. Kehausan mata pemotong paling minimum adalah pada kelajuan pemotongan 90rev/min dan kadar kelajuan pemotongan 0.13mm/rev.

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LIST OF SYMBOLS

°C	Degree Celsius
γ	Gamma
R^2	Coefficient of determination

LIST OF ABREVIATIONS

DOE	Design of Experiments
AISI	American Iron and Steel Institute
ANOVA	Analysis of variance
HV	Hardness value
RPM	Revolutions per minute
FCC	Face centred cubic
BCT	Body central tetragonal
CVD	Chemical vapour deposition
SS	Sum of squares
CS	Cutting speed

IN THE NAME OF ALLAH,

THE MOST BENEFICENT, THE MOST MERCIFUL

A special dedication of This Grateful Feeling to My..

Beloved parents, En.Zubir bin Daud and Pn. Laila binti Mohd Zain for giving me full of moral and financial support. It is very meaningful to me in order to finish up my degree's study. Not forgetting also to all my loving siblings, and also to my beloved one.

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CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

During machining process, friction between work piece and grain cause high temperature on cutting tool. The effect of this generated heat that will sooner decrease the tool life, increase surface roughness and decrease the dimensional sensitivities of work material. This case is more important when machining of difficult-to-cut materials, when more heat would be observed.

The application of cutting fluid or coolant is an alternative that has been used widespread in all machining process. Cutting fluid is used to reduce friction and wear (improving tool life and surface finish), to reduce cutting force and energy consumption, to cool the cutting zone, to wash away chips and to protect machined surfaces from environmental corrosion.

However, because of their damaging influences on the environment, their applications have been limited in machining process. Cutting fluid can be expensive and seriously degrade quality of environment. Consequently, many governments recommend the manufacturers to reduce the volume and the toxicity of their cutting fluids. It is potentially cause health problem to the operator. Besides, cutting fluids requires proper recycling and disposal, thus adding to the cost of the machining operation.

For these reasons dry machining has become an increasingly important approach. In dry machining, no coolant or lubricant is used. The implementation of dry machining will bring down the manufacturing cost.